REMARKS

The purpose of this amendment is to correct the above cited application so that it is in condition for allowance. The concerns of the Examiner are discussed below in the same order as they appear in the Office Action.

Claims 1-14 were rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-25 of U.S. Patent No. 5,548,128. In response herewith is a timely filed terminal disclaimer in compliance with 37 CFR 1.32(c) to the conflicting patent is shown to be commonly owned with this application.
All the claim informalities cited by the Examiner are corrected in the present amendment.

Claims 1 and 2 were rejected under 35 USC § 103 (a) as being unpatentable over Luryi U.S. Patent No. 4,769,341 in view of Nakagawa et al. ("Nakagawa") U.S. Patent No. 5,523,592. In response claims 1 and 2 have been cancelled and claim 3 is amended herewith to contain the limitations of claims 1 and 2.

A clean copy of this claim is attached as Exhibit A. All the informalities are corrected herewith and none of the remaining claims were rejected from prior art.

In accordance with Section 714.01 of the M.P.E.P., the following information is presented in the event that a call may be deemed desirable by the Examiner: WILLIAM G. AUTON, A/C 781-377-3773.

Respectfully submitted,

WILLIAM G. AUTON
Attorney for Applicants

Exhibit A

Claims

3. A bipolar band-to-band infrared photodetector-diode, or laser diode, or light emitting diode, or amplifier, or electrooptic modulator-diode comprising

(a) silicon substrate, wherein the substrate is doped N-type or P-type while the capping Layer is doped P-type or N-type to form an NIP or PIN diode,

(b) a strain-relaxed $Ge_{1-y}Sn_y$ or $Ge_{1-y-z}Sn_ySi_z$ buffer layer upon Si, known as a virtual substrate, VS wherein the VS is $Ge_{1-y}Sn_y$ and the active region is a strain balanced type-I stack of compressive $Ge_{1-2y}Sn_{2y}$ quantum wells with tensile Ge barriers,

(c) an active direct-bandgap region made up of a single-quantum-well heterostructure or a multi-quantum-well stack,

(d) a strain-relieved capping layer of $Ge_{1-y}Sn_y$ or $Ge_{1-y-z}Sn_ySi_z$ matching the VS composition,

(e) metallic electrical contacts to the Si substrate and capping layer.

4. The devices of claim 3 wherein the composition y ranges from 0.02 to 0.15 for device operation at wavelengths ranging from 1.55 to 5.00 μm.

5. The photodetector devices of claim 3 in which the substrate is doped N or P type and the cap layer contact is an Schotty barrier metal.

6. The photodetector devices of claim 3 in which the substrate is undoped and an interleaved pair of metal electrodes is employed upon the cap layer.

7. The devices of claim 3 wherein the VS is $Ge_{1-y}Sn_y$ and the active region is an unsymmetrically strained type-II heterostructure with holes confined in a tensile Ge layer and electrons confined in the relaxed buffer layer.

8. The devices of claim 3 wherein the VS is $Ge_{1-y-z}Sn_ySi_z$ and the active region is an unsymmetrically strained type-I heterostructure with electrons-and-holes confined in a tensile Ge layer.

9. The devices of claim 8 wherein y and z are approximately 0.2.

10. A unipolar intersubband long-wave-infrared photodetector-diode, or laser diode, or light emitting diode, or amplifier, or electrooptic modulator diode comprising:

(a) silicon substrate

(b) strain-relaxed $Ge_{1-y}Sn_y$ buffer layer upon Si, known as a virtual substrate, VS

(c) an active direct-bandgap region made up of a strain-balanced type-I multi-quantum-well stack which has compressive $Ge_{1-2y}Sn_{2y}$ wells and tensile Ge barriers,

(d) a strain-relieved capping layer of $Ge_{1-y}Sn_y$ that matches the VS composition,

(e) metallic electrical contacts to the Si substrate and/or capping layer.

11. (Amended) the photodetector devices of claim 10 wherein the VS and cap and quantum wells are doped N type 0.

12. (Amended) the photodector devices of claim 10 wherein the VS and cap and quantum wells are doped P type.

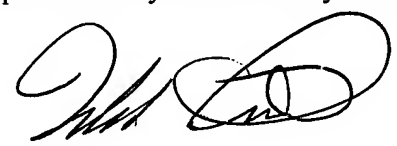
13. The laser, emitter, amplifier and modulator devices of claim 10 wherein the VS and cap are both doped N-type or both doped P-type for electron injection or for hole injection, respectively.

14. (Original) the laser, emitter, amplifier and modulator devices of claim 10 wherein the resonant tunneling of injected carriers is used between adjacent periods of the active region in the manner of a quantum cascade.

patent shall be the same as the legal title to U.S. Patent Application Serial No. 10/722,611, this agreement to run with any patent granted on the above-identified U.S. Patent Application 10/722,611 and to be binding upon the grantee, its successors or assigns.

Signed at Hanscom AFB on the 16 day of November, 2004

U.S. Government as represented by the Secretary of the Air Force.



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For the Government of the U.S. of America as represented by the Secretary of the Air Force.